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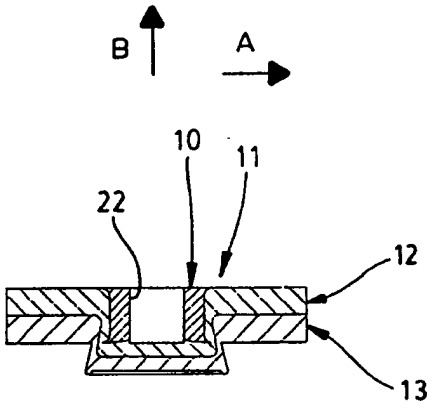

(57) Abstract

In a clinched joint (11) to secure panels (12, 13) together, a rivet or slug (10) is driven into the clinched joint (11) as it is formed, and the inner end of the rivet or slug (10) is outwardly-deformed to increase both the shear and axial separation load strengths of the clinched joint (11). Rings (410) or components (510, 610), which may form parts of sub-assemblies, may also be secured to the pannels (412, 413; 512, 513; 612, 613) by the clinching methods, the rings (410) or components (510, 610) acting as the dies for the joints (411, 511, 611).

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Title: "IMPROVED PANEL CLINCHING METHODS"

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improved panel clinching methods. The term "clinching" is also known as "press joining" or "integral fastening".

2. Prior Art

Spot welding is the most commonly used technique for joining vehicle body components in the automotive industries. As the strength of each spot weld cannot be guaranteed, eg. due to the inclusion of rubbish between the components, or poor weld penetration, designers must increase the number of welds to ensure adequate joint strength.

Spot welding has not yet been developed as an accurate, reliable method for joining galvanised steel or aluminium components.

With galvanised steel, welding action destroys the galvanising about the weld site, making it liable to corrosion.

Aluminium has great potential in the automobile field due to its light weight, but the lack of a suitable spot welding method is one reason which has minimised its application.

One alternative to spot welding is the use of self-piercing rivets, and a method of, and apparatus for, the fastening of metal panels with self-piercing rivets is disclosed in US Patent No 4,615,475 (Fuhrmeister) (= International Publication Number WO 84/04710).

A further alternative method is metal clinching, where two sheets of metal are deformed into a locking engagement using a punch-and-die combination. Examples of metal clinching methods are disclosed in:

1. DE 4009813 (Fraunhoffer-Ges Ford Ange);

2. DE 1452820 (Philips Patentverwaltung GmbH);
3. DE 3726392 (Kuka Schweissanlage);
4. EP 330061 (Eckold W. & Co GmbH);
5. EP 215449 (Rapp E.);
6. GB 2244946 (Fairacre Limited);
7. GB 2123734 (BTM Corporation);
8. US 3919955 (Du Vernay); and
9. US 387599 (Ladouceur et al).

While these methods enable metal sheets to be joined together, they have relatively low shear and axial load strengths, and the joints do not have an outer face substantially flush with the surrounding sheet metal (and are so not applicable in exposed areas, eg. within an engine compartment).

SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide a panel clinching method where the shear strengths of the clinching joint is increased.

It is a preferred object to provide a method where the axial load strength of the clinched joint is increased.

It is a further preferred object to provide a method where the outer face of the joint may be substantially flush with the surrounding sheet metal.

It is a still further preferred object to provide a method where ancillary components may be supported by or from the clinched joint.

It is a still further preferred object to provide a method where the clinched joint may be "capped" to constrain any stress lines in the metal panels in the region of the joint.

Other preferred objects will become apparent from the following description.

In one aspect, the present invention resides

in a panel clinching method wherein:

a hollow rivet or full tubular slug is driven or inserted into a clinched joint and at least the inner end of the shank of the rivet or slug is outwardly-deformed within the joint.

The term "outwardly-deformed" shall be used to include deformation of all or part of the shank or stem of the rivet or slug in at least one direction lateral (or transverse) to the longitudinal axis of the shank or stem.

In a single stage method, the rivet or slug may be inserted into the joint as the joint is formed, the rivet or slug co-operating with the punch to deform the panels into the supporting die. In a two-stage process, the rivet or slug co-operates with the metal panels into the die, and a sleeve external to the punch then deforms the rivet or slug within the joint.

The bore of the rivet or slug may be threaded, serrated or otherwise profiled to engage and support an anchor for, eg. a wiring loom support, a trim cover panel fastener or the like. A plastic insert may be fitted to the rivet or slug to provide a flush outer face.

Preferably, the panels are pre-clamped to the die before the punch drives the rivet or slug into the panels to form the clinched joint; or before the clinched joint is formed and the rivet or slug is then inserted into the joint.

In a second aspect, the present invention resides in a panel clinching method where a solid or semi-tubular rivet or slug is driven or inserted into a clinched joint and at least the inner end of the shank of the rivet or slug is outwardly-deformed within the joint.

In a single stage process, the rivet or slug

is interposed between the punch and the outer panel (to be joined) and the rivet or slug is used to deform the metal panels into the die as the clinched joint is formed.

In a two-staged process, a conventional button-type clinched joint is formed and then the rivet or slug is pressed into the joint by the punch.

Preferably, the panels are pre-clamped to the die before the clinched joint is formed.

In a third aspect, the present invention resides in a panel clinching method where a ring, or a body or component having a tapered bore or recess, is supported by a die and at least one panel is deformed into the ring or the bore or recess to form a clinched joint therewith.

Preferably, the panels are deformed behind the ring or into engagement with inwardly-divergent walls in the recess.

In a fourth aspect, the method of the third aspect is used in combination with the hollow rivet or tubular slug of the first aspect, or the solid or semi-tubular rivet or slug of the second aspect.

In a fifth aspect, the present invention resides in a clinched joint for panels formed by the method of any one of the first to fourth aspects.

While the invention is particularly suitable for joining sheet metal panels, it is also suitable for polymeric materials (eg. polyethylene, polyurethane, polypropylene, nylon) where one or more metal panels are substituted by panels of polymeric material. For example, the methods are suitable for joining, eg. an aluminium sheet to a polypropylene sheet, where the polymeric sheet may be locally preheated (eg. by the supporting die) to assist in the "flow" of the polymeric material as the joint is formed. The rings or

components may also be formed of polymeric material and be clinched to metal and/or polymeric material sheets.

The shanks of the rivets or slugs may be provided with external splines, grooves, teeth or other protrusions or recesses to provide additional grip between the rivets or slugs and the panels in the clinched joint.

Adhesives can be applied, eg. to the shanks of the rivets or slugs to assist bonding of the rivets or slugs to the panels. Adhesives may also be provided within the bore of the tubular or semi-tubular rivets or slugs to be extruded into the clinched joint, as the rivets or slugs are deformed, to assist the bonding of the rivets or slugs to the panels.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a sectional side view of a hollow rivet or tubular slug suitable for clinching two panels of metal together;

FIGS 2 to 5 are sectional side views of the steps in a two-stage process of forming a clinched joint of a first embodiment;

FIG 6 is a sectional side view of the clinched joint of the first embodiment;

FIG 7 is a sectional side view of a modified tubular rivet or slug;

FIGS 8 to 11 are sectional side views of the steps in a single-stage process of forming a clinched joint of a second embodiment;

FIG 12 is a sectional side view of the clinched joint of the second embodiment;

FIG 13 is a sectional side view of a solid rivet or slug;

FIGS 14 and 15 are sectional side views of the steps of forming a clinched joint of a third embodiment;

FIG 16 is a sectional side view of the

clinched joint of the third embodiment;

FIG 17 is a sectional side view of a semi-tubular rivet or slug;

FIGS 18 to 22 are sectional side views of the steps of forming a clinched joint of the fourth embodiment;

FIG 23 is a sectional side view of the clinched joint of the fourth embodiment;

FIG 24 is a (a) top plan, (b) sectional side, and (c) bottom plan view of a ring;

FIG 25 is a sectional view of the clinched joint of the fifth embodiment;

FIG 26 is a similar view of a modified form of the clinched joint of FIG 25;

FIG 27 is a (a) top plan, (b) sectional side, and (c) bottom plan view of a component;

FIG 28 is a sectional side view of a clinched joint of a sixth embodiment;

FIG 29 is a similar view of a modified form of the clinched joint of FIG 28;

FIG 30 is a (a) top plan, (b) sectional side, and (c) bottom plan view of a second component;

FIG 31 is a sectional side view of a clinched joint of a seventh embodiment; and

FIG 32 is a sectional side view showing the clinched joint of FIG 31 where the component is supported in a die.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS 1 to 6, the tubular rivet 10 of FIG 1 is driven into the metal panels to form the clinched joint 11 of FIG 6.

The metal panels 12, 13 to be joined together are supported on the die assembly 14 of a clinching tool(s), the die assembly having expandable and contractable collets 16 associated with a collet holder

17 and anvil 18 arranged to allow the joint 11 to be released when formed.

The clinching tool 15 has a pre-clamping head 19 which clamps the metal panels 12, 13 to the die assembly and has internal (spring-loaded) balls 19A to locate and centralise the rivet 10. A punch 20 is slidably journalled in a sleeve 21, slidably journalled in the pre-clamping head 19, and the punch 20 and sleeve 21 are connected to respective hydraulic rams (not shown).

The operation of the clinching tool 15 will now be described.

After the metal panels 12, 13 are clamped to the die assembly 14 by the pre-clamping head 19, the punch 20 is driven through the rivet 10 into engagement with the upper panel 12; the sleeve 21 engaging the rivet 10. The punch 20 and rivet 10 are advanced to deform the metal panels 12, 13 into the die assembly 14 (see FIG 4). The sleeve 21 is then advanced to cause the inner end of the rivet 10 to be outwardly-deformed (see FIGS 5 and 6).

The anvil 18 can be spring-loaded or forcibly raised as a post-forming operation against the punch 20 to assist in deforming the rivet or slug.

The insertion and deformation of the rivet assists in locking the metal panels 12, 13 together, with increase in the shear and axial separation strength(s) (ie. in the direction of arrows A and B, respectively).

The bore 22 of the rivet 10 may be threaded to receive a fastener or plug to support, eg. an electrical wiring loom or a plastic insert to form a flush cover for the clinched joint 11.

Referring now to FIGS 7 to 12, a modified tubular rivet 110 has a tapered end 123 to its inner

bore 122.

In this one-stage method, the sleeve 21 is eliminated and the punch 120 is slidably journalled in the pre-clamping head 119. The metal sheets 112, 113 are supported by the die assembly 114 and clamped thereto by the clamping head 119. The punch 120 engages the rivet 110 (see FIG 9) and drives the rivet 110 into the metal panels 112, 113 which are deformed into the die assembly 114 (see FIG 10). The punch 120 is further advanced (see FIG 11) to deform the inner end of the rivet 110 to form the clinched joint 111 (see FIG 12).

To increase the strength of the clinched joints 11, 111, a solid or semi-tubular rivet or slug may be used.

Referring now to FIGS 13 to 16, a solid slug 210 (FIG 13) has a concave recess 222 at its lower end and is used to form the clinched joint 211 of FIG 16.

The metal sheets 212, 213 are clamped to the die assembly 214 by the clamping head 219 (see FIG 14). The punch 220 is advanced to drive the slug 210 (as an extension of the punch 220) into the metal panels 212, 213 to deform the panels into the die assembly 214 to form the clinched joint 211. It will be noted that the head of the slug 210 is flush with the outer face of panel 212 and such a joint is suitable where aesthetic appeal is required, eg. on a visible surface of a vehicle body.

The semi-tubular slug 310 (see FIG 17) has a tapered end 323 to its bore 322.

In the two-stage process shown in FIGS 18 to 23, the metal panels 312, 313 are pre-clamped to the die assembly 314 by the clamping head 319 and the punch 320 is advanced (see FIG 19) to form a conventional button-type clinched joint 311A (see FIG 20). The punch 320 is retracted and a semi-tubular slug 310 is placed in

the clinching tool.

The pre-clamping head 319 clamps the panels (see FIG 21) and the punch 320 is advanced to drive the slug 310 into the clinched joint 311A to deform the slug 310 to form the clinched joint 311 (see FIG 23).

Referring now to FIGS 24 and 25, the rivets or slugs (10, 110, 210, 310) may be substituted by a (metal or plastic) ring 410 which engages the lower panel 413 to lock the clinched joint 411, the panels 412, 413 being deformed into the divergently tapered bore 422 of the ring 410. The ring 410 is supported by a die assembly (not shown) as the punch (not shown) deforms the panels 412, 413, the ring 410 acting as the die body.

As shown in FIG 26, straps or clips 424 may be formed integrally with the ring 410, eg. to secure wiring to a vehicle body. If requested, the ring 410 can be combined with the method of FIGS 17 to 23, where a solid or semi-tubular slug is pressed into the clinched joint 411 to form a flush surface with panel 412.

A component 510 (see FIGS 27 to 29), with a tapered recess or bore 522, and a screw-threaded hole 525 (as part of a sub-assembly - not shown) can also be employed as the die for the clinched joint 511 and provide a mount for the sub-assembly secured to the panels 512, 513.

As shown in FIG 29, a solid slug 210 can be pressed into the clinched joint 511. (The slug 210 may be screw-threaded and have a slot, Philips-head slot or an Allen-head recess to enable the slug 210 to be removed later if required for dis-assembly of the joint 511.)

FIGS 30 to 32 show the attachment of a second component 610, with a bore 622 and a plain spigot (FIG 30) or screw-threaded end spigot 626 (FIG 31), secured

to the clinch-joint 611. (The spigot may also be profiled, eg. engageable in a catch or lock means.)

FIG 32 shows the component 610 supported by a die assembly 614 during the clinching step.

In the methods shown in FIGS 24 to 26; 27 to 29; and 30 to 32, two panels 412, 413; 512, 513; 612, 613 are shown secured in the ring 410, and components 510, 610. The methods are also applicable to securing a single panel to the ring 410 on components 510, 610.

In addition, in all of the methods, one or both panels may be a polymeric sheet (eg. polypropylene), it being preferred that the inner sheet, (eg. 13, 113) being the polymeric sheet and the die assembly may be heated at the location of the clinched joint to assist "flow" of the polymeric material.

For improved recycling, it is preferred that the rivets 10, 110; slugs 210, 310; ring 410; or components 510, 610 be of the same type of material as the panels as this will obviate the need for disassembly of the joints.

As an indication of the advantage of methods of the present invention, the use of an 8mm solid rivet or slug in conjunction with a clinched joint increase the shear strength of a sheet metal joint by 50% and the strength to both the shear and axial separation directions can be maintained within controlled limits, unlike spot welds. This means the number of clinched joints can be much less than the number of spot welds, and the joints can also support sub-assemblies.

Various changes and modifications may be made to the embodiments described and illustrated without departing from the scope of the present invention defined in the appended claims.

CLAIMS

1. A panel clinching method wherein:

a hollow rivet or tubular slug is driven or inserted into a clinched joint and at least the inner end of the shank of the rivet or slug is outwardly-deformed within the joint.

2. A method according to Claim 1 wherein:

the rivet or slug is inserted into the clinched joint as the clinched joint is formed, the rivet or slug co-operating with a punch to deform the panels being joined into a supporting die.

3. A method according to Claim 1 wherein:

the rivet or slug co-operates with a punch to deform the panels being joined into a supporting die, and a sleeve external to the punch is advanced relative to the punch to deform the rivet or slug within the clinched joint.

4. A method according to any one of Claims 1 to 3 wherein:

the panels to be joined are pre-clamped to the die before the punch drives the rivet or slug into the panels to form the clinched joint.

5. An apparatus for effecting the method of claim 2 or Claim 4 including:

a die to support the panels to be joined; and

a punch having a nose receivable in a bore through the rivet or slug;

so arranged that the nose of the punch enters the bore and the punch is advanced so that the rivet or slug and the nose of the punch deform the panels into the clinched joint in the die, to outwardly-deform at least the inner end of the shank of the rivet or slug in the clinched joint.

6. An apparatus for effecting the method of

Claims 3 or 4 including:

a die to support the panels to be joined;

a punch having a nose receivable in a bore through the rivet or slug; and

a sleeve external to the punch;

so arranged that the nose of the punch enters the bore and the punch is advanced so that the rivet or slug and the nose of the punch deform the panels into a clinched joint in the die; and

the sleeve is then advanced to outwardly-deform at least the inner end of the shank of the rivet or slug in the clinched joint.

7. An apparatus according to Claim 5 or Claim 6 wherein:

a pre-clamping head to clamp the panels to the die before the punch, and rivet or slug, is advanced.

8. A clinched joint between two panels formed by the method of any one of Claims 1 to 4.

9. A panel clinching method wherein:

a solid or semi-tubular rivet or slug is driven or inserted into a clinched joint and at least the inner end of the shank of the rivet or slug is outwardly-deformed within the clinched joint.

10. A method according to Claim 9 wherein:

the rivet or slug is interposed between a punch and the outer of the panels to be joined, and the rivet or slug deform the panels into a die as the punch is advanced and the clinched joint is formed, the punch being further advanced to deform at least the inner end of the shank of the rivet or slug within the clinched joint.

11. A method according to Claim 9 wherein:

a punch forms a conventional button-type clinched joint in the panels to be joined, the panels

being supported by a die; and

the rivet or slug is interposed between the punch and the clinched joint; and

the punch is advanced to drive the rivet or slug into the clinched joint and then further advanced to deform at least the inner end of the shank of the rivet or slug in the clinched joint.

12. A method according to any one of Claims 9 to 11 wherein:

the panels to be joined are pre-clamped to the die before the punch drives the rivet or slug into the panels to form the clinched joint.

13. An apparatus for effecting the method of any one of Claims 9 to 12 including:

a die to support the panels to be joined; and

a punch to drive the rivet or slug, or the panels, into the die to deform the panels to form the clinched joint, and to deform at least the inner end of the shank of the rivet or slug in the clinched joint.

14. An apparatus according to Claim 13 and further including:

a pre-clamping head to clamp the panels to the die before the punch, or rivet or slug, are advanced.

15. A clinched joint between two panels formed by the method of any one of Claims 9 to 12.

16. A panel clinching method wherein:

a ring, or a component having a tapered bore recess, is supported by a die; and

at least one panel is deformed into the ring, or the bore or recess, to form a clinched joint between the panel(s) and the ring or component.

17. A method according to Claim 16 wherein:

the panel(s) are deformed behind the ring or

into engagement with the inwardly-divergently tapered wall of the bore or recess.

18. An apparatus for effecting the method of Claim 16 or Claim 17 including:

a die to support the ring or component, the panel(s) to be joined being supported by the ring or component; and

a punch to deform the panel(s) into the ring, or the tapered bore or recess of the component, to form the clinched joint.

19. A clinched joint formed by the method of Claim 16 or Claim 17.

20. A panel clinching method as claimed in any one of Claims 1 to 4; or Claims 9 to 12; or Claims 16 or 17; wherein:

at least one panel is a metal sheet and at least one panel is a polymeric sheet, the polymeric sheet being pre-heated in the zone of the clinched joint to encourage the "flow" of the polymeric material as the panels are deformed.

21. A panel clinching method as claimed in any one of Claims 16, 17 or 20 wherein:

the ring or component is formed of metal or polymeric material.

22. A panel clinching method as claimed in any one of Claims 1 to 4; or Claims 9 to 12; or Claims 16 or 17; or Claims 20 or 21; wherein:

an adhesive is applied to the rivet, slug, ring or component to assist bonding between the panels and the rivet, slug, ring or component.

23. A panel clinching method as claimed in any one of Claims 1 to 4 wherein:

an adhesive is applied to the bore of the tubular rivet or slug, the adhesive being extruded into the clinched joint when the tubular rivet or slug is

deformed to assist bonding between the panels and the rivet or slug.

24. A panel clinching method as claimed in any one of Claims 1 to 4; or Claims 9 to 12; wherein:

the rivet or slug has a shank with external splines, grooves, teeth or other protrusions or recesses to provide additional grip between the rivet or slug and the panels in the clinched joint.

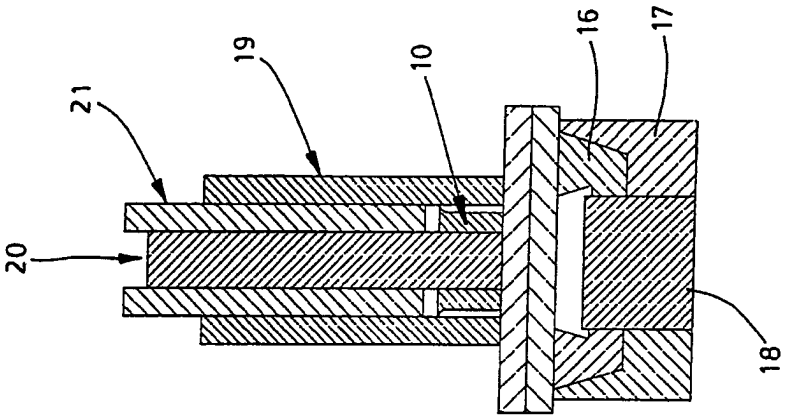

Fig.3

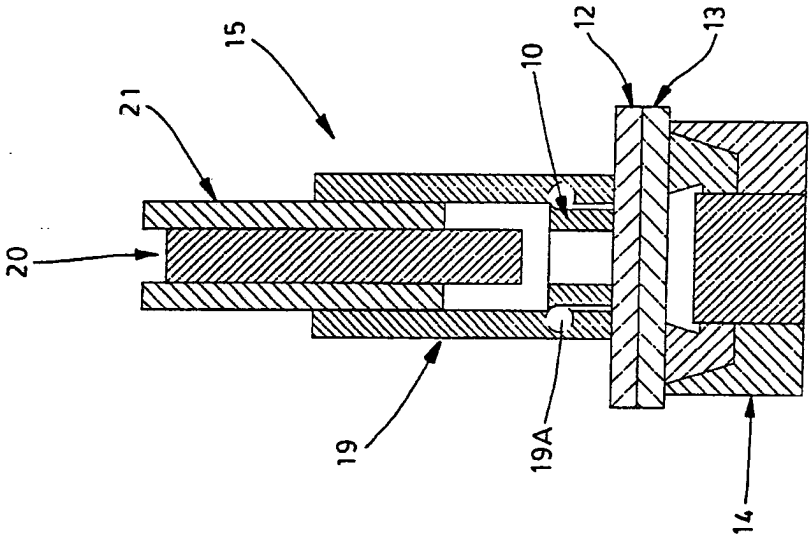

Fig.2

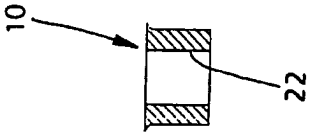

Fig.1

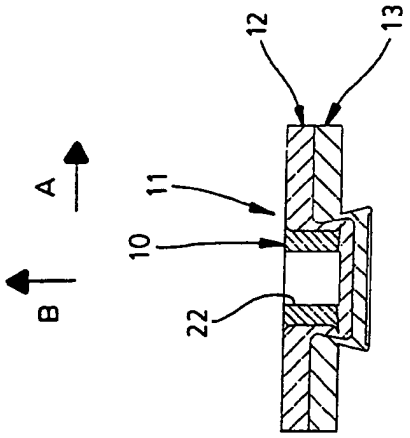

Fig.6

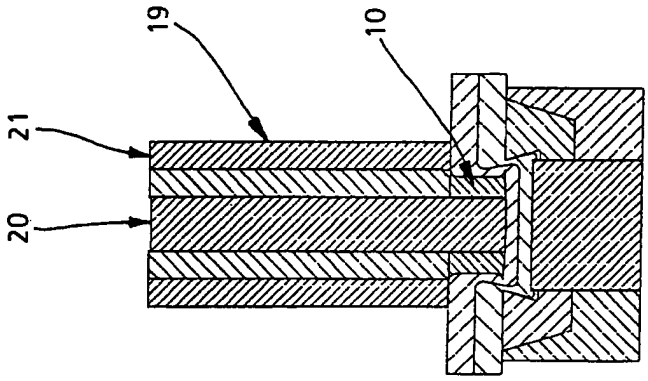

Fig.5

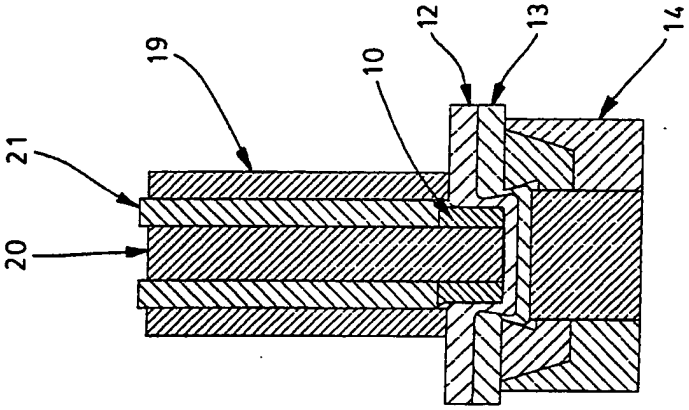

Fig.4

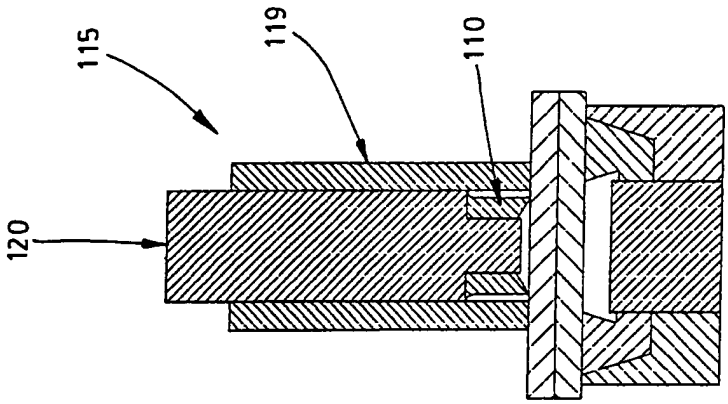

Fig.9

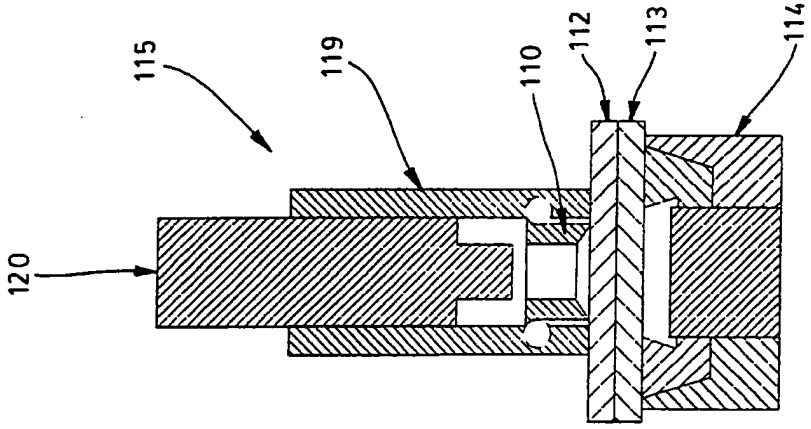

Fig.8

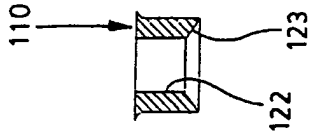

Fig.7

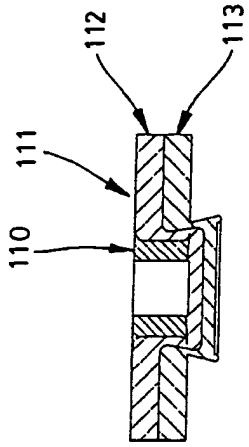

Fig. 12

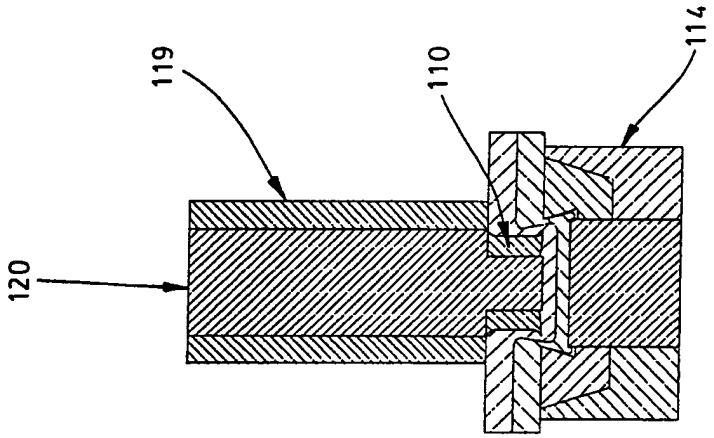

Fig. 11

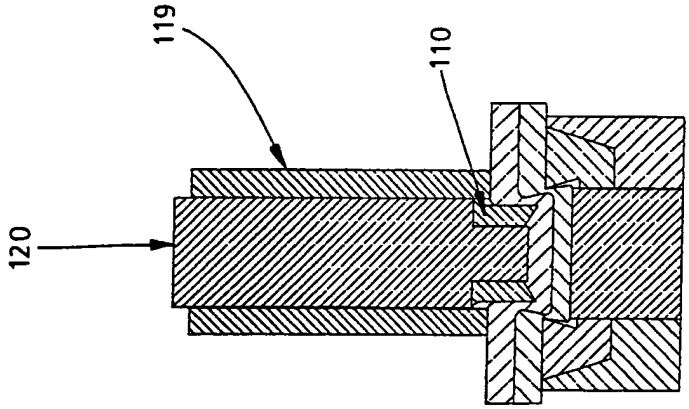

Fig. 10

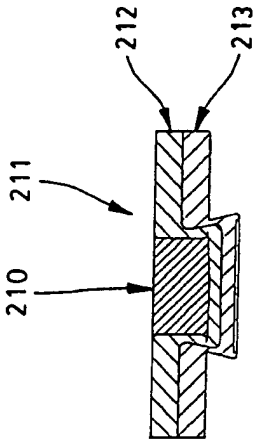

Fig. 16

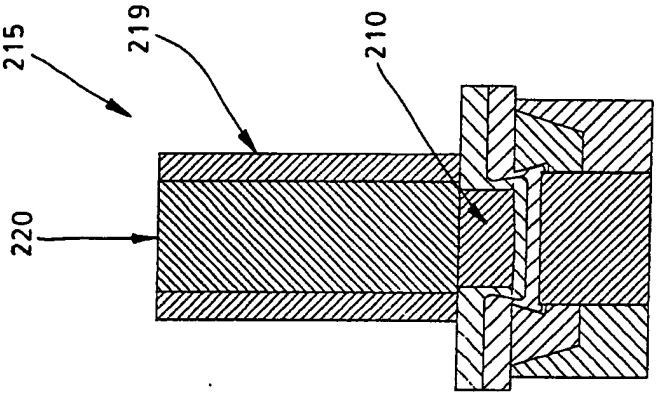

Fig. 15

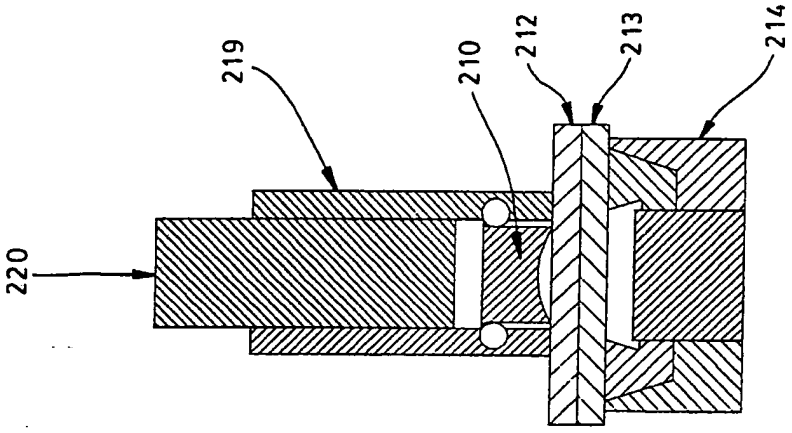

Fig. 14

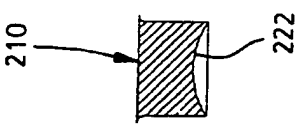

Fig. 13

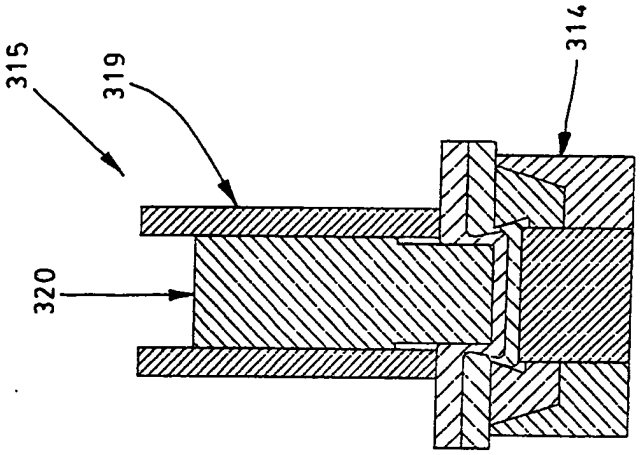

Fig. 19

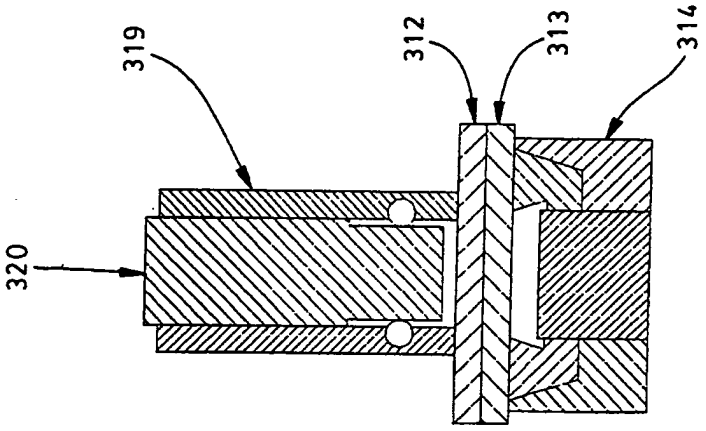

Fig. 18

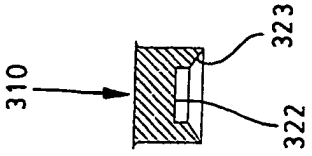

Fig. 17

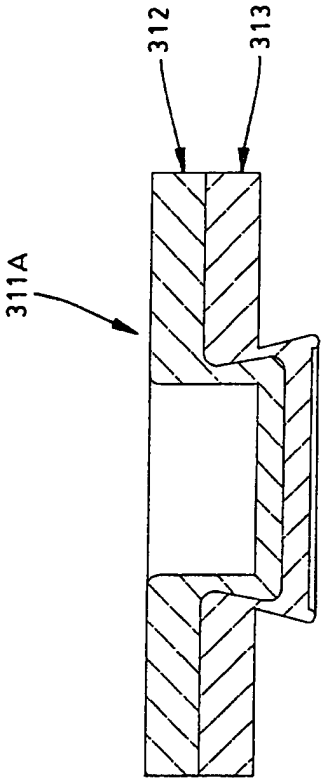

Fig.20

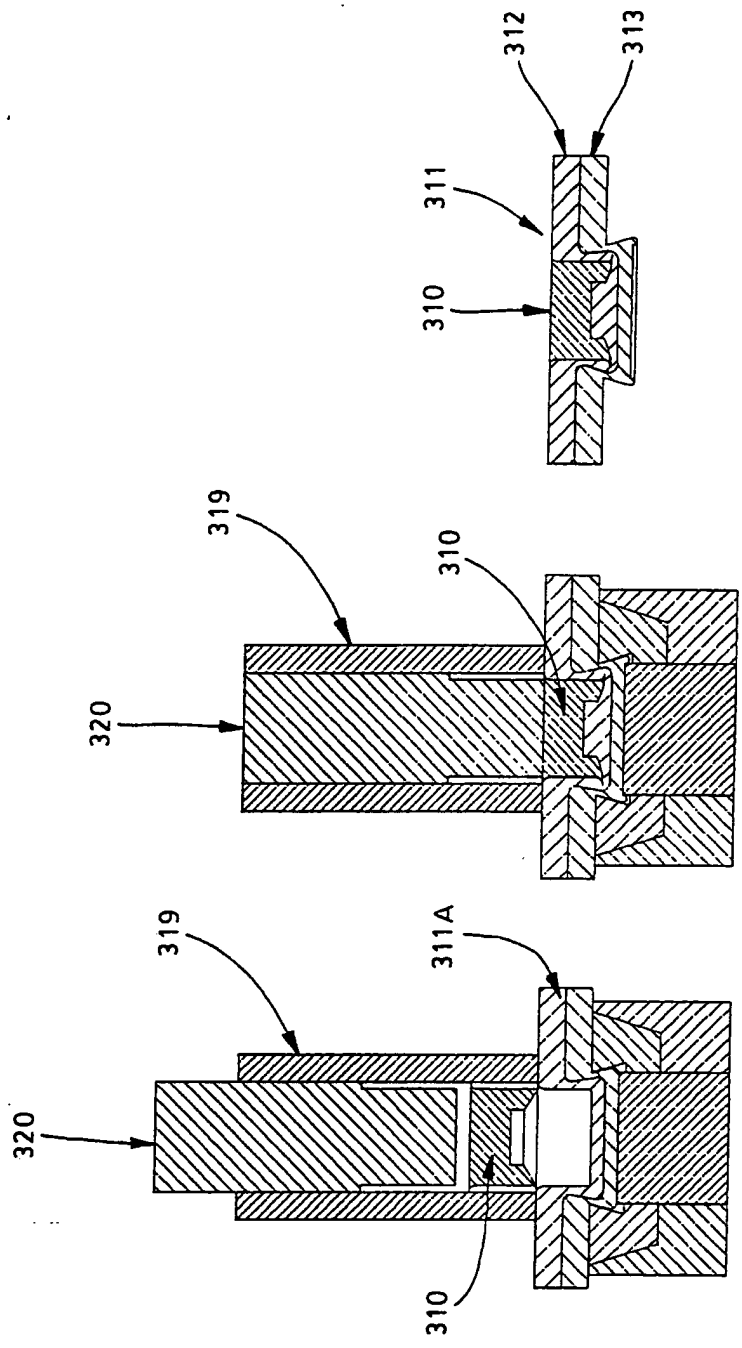

Fig.23

Fig.22

Fig.21

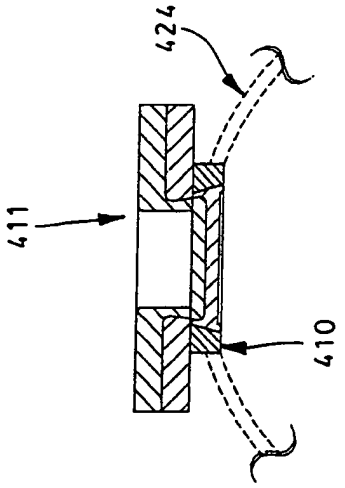

Fig.26

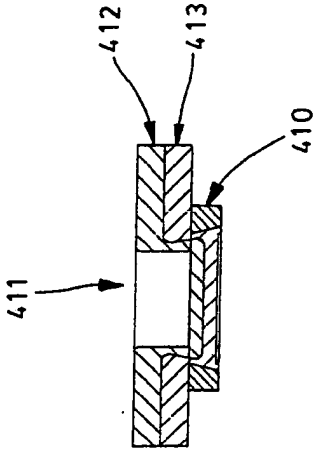

Fig.25

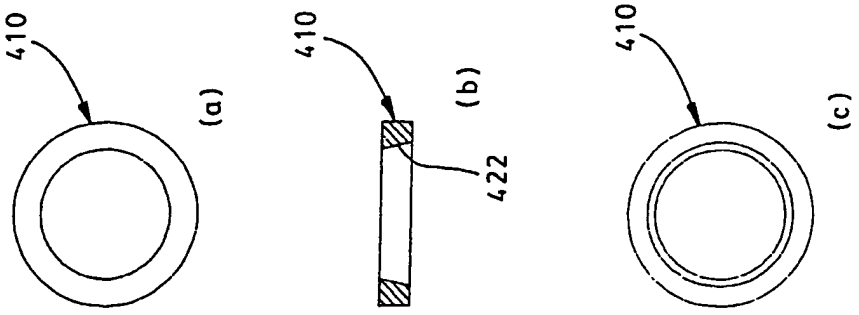

Fig.24

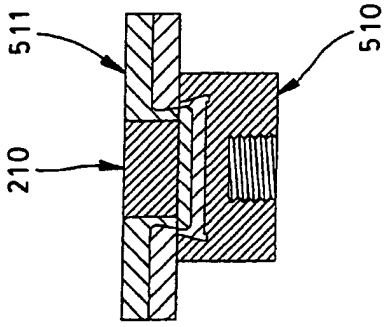

Fig.29

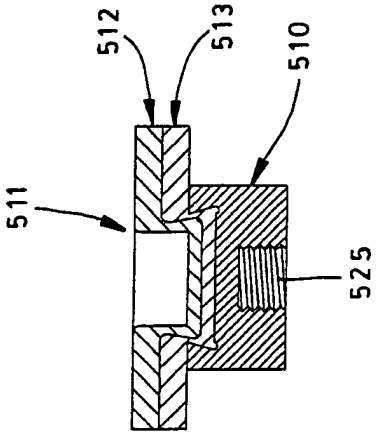

Fig.28

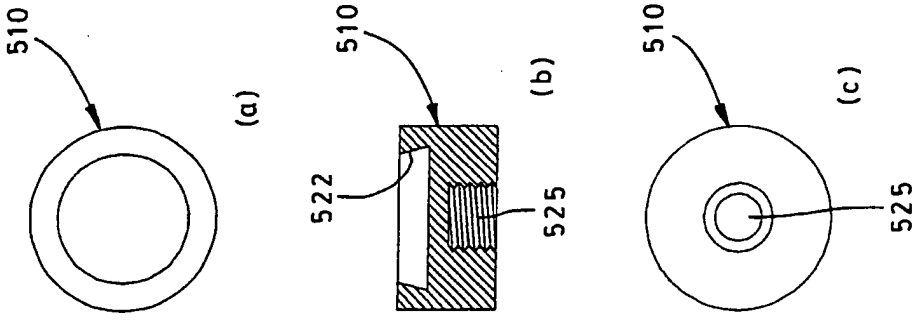

Fig.27

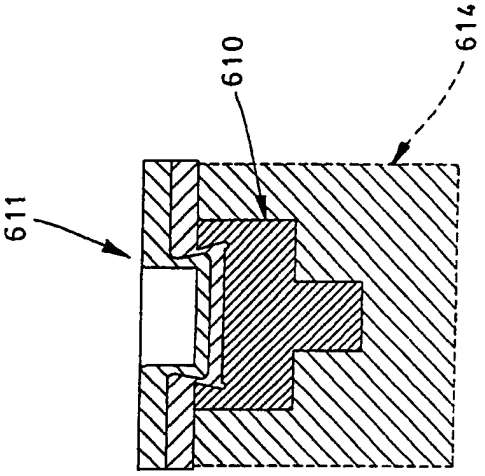

Fig.32

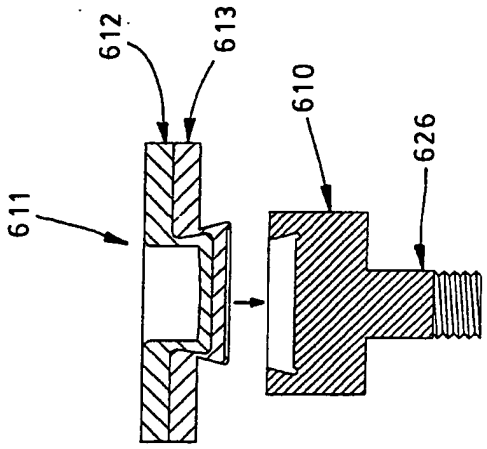

Fig.31

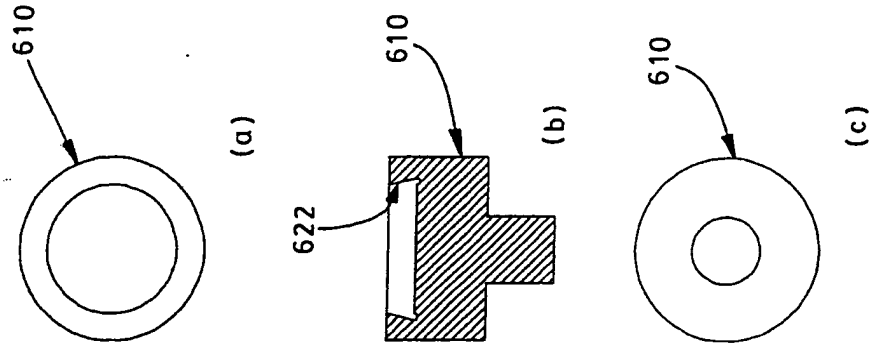

Fig.30

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU92/00631

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[5] B21J 15/04; B21D 39/03 B23P 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[5] B21J 15/04 B21D 39/03 B23P 11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
DERWENT : B23P 11/-:CRIMP:RIVET:DIE:JOINT:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	AU,B, 7608/61 (250789) (J & S ENGINEERS) 2 May 1963 (02.05.63) See whole document	1-5, 9-11, 13, 16, 24
X	AU,B, 70379/74 (481222) (OCEAN INVESTMENTS) 8 January 1976 (08.01.76) Pages 6-9, Fig. 1-3	9-12
Y	Pages 6-9, Fig. 1-3	1-4
X	GB,A, 912516 (BELLING & LEE LTD) 12 December 1962 (12.1262) Pages 1-2, Fig. 1 & 2	9-11, 13
Y	Pages 1-2, Fig. 1 & 2	1-3

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
3 March 1993 (03.03.93)	08 MAR 1993 (08.03.93)
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. 06 2853929	Authorized officer D.G. FRY Telephone No. (06) 2832130

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INTERNATIONAL SEARCH P~ ~ORT

International application No.
PCT/AU92/00631

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	DE,A, 3923182 (FRAUENHOFER-GESELLSCHAFT) 24 January 1991 (24.01.91) Columns 3-5, Fig. 3-5, 7	16-18
Y	EP,A, 351715 (HILTI) 24 January 1990 (24.01.90) Column 1-4 Fig. 1-5	1-3, 5, 9-11
X	AU,B, 11072/61 (264736) (J & S ENGINEERING) 9 May 1963 (09.05.63) Pages 5, 6 Fig. 7	9-10
Y	Pages 5, 6 Fig. 7	1-2
Y	US,A, 3022687 (RICHARDS) 27 February 1992 (27.02.62) Column 1-3 Fig. 3, 5, 8	1-3, 9-10, 16-18
Y	AU,B, 32537/71 (457656) (ILLINOIS TOOLWORKS) 22 February 1973 (22.02.73) Pages 5-7, Fig. 1-4	1-3, 9
Y	DE,A, 3726392 (KUKA SCHWEISSANLAGEN & ROBOTER GmbH) 16 February 1989 (16.02.89) Columns 6-9, Fig. 8-11	13
Y	AU,A, 76786/91 (WEBB) 17 October 1991 (17.10.91) Page 10-13 Fig. 1-3	4, 12, 16
X	US,A, 3198155 (FRAZE) 3 August 1965 (03.08.65) Columns 3-5 Fig. 8-17	16
Y	Patent Abstracts of Japan, M-823, page 131, JP,A, 1-22427 (TOYO SEIKAN KAISHA LTD) 25 January 1989 (25.01.89) Abstract	16

INTERNATIONAL SEARCH P[illegible]ORT
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International application No.
PCT/AU92/00631

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Patent Document Cited in Search Report		Patent Family Member					
AU	74/70379	BE	809810	BR	7405945	CA	1019604
		CH	589235	DK	3867/74	ES	428403
		FR	2238080	IT	1007043	JP	50037954
		NL	7317677	SE	7409207	US	3909913
DE	351715	EP	3824817				
AU	71/32537	AR	195269	BE	771485	BR	7105323
		CA	949501	DE	2141119	FR	2102363
		GB	1353414	US	3724738		
AU	91/76786	EP	523134	WO	9115316		
							END OF ANNEX